

Amend

~~wherein said aqueous treatment agent solution consists
essentially of an oxidizing agent and an alkaline component.~~

REMARKS

At the outset, the Applicants wish to thank Supervisory Patent Examiner Benjamin Utech for the many courtesies extended to the undersigned attorney during the personal interview on September 8, 1999, at the U.S. Patent and Trademark Office. The substance of this interview is set forth in the Examiner Interview Summary Record, and in this Amendment.

The Patent Examiner has rejected claims 1, 2, 4, and 6 to 8 as being anticipated by Nakashima U.S. Patent No. 5,643,368. The Patent Examiner has rejected claims 3, 5, and 9 to 12 as being unpatentable over Nakashima U.S. Patent No. 5,643,368 in view of Parassis U.S. Patent No. 4,950,359 further in view of Hayashida U.S. Patent No. 5,580,846.

The present invention is directed to a process for treating a polished semiconductor wafer consisting essentially of the steps of polishing a surface of a semiconductor wafer; immediately after polishing the semiconductor wafer, bringing the semiconductor wafer into contact with an aqueous treatment agent

solution for oxidizing the polished surface by action of the aqueous treatment agent solution wherein said aqueous treatment agent solution consists essentially of an oxidizing agent and an alkaline component.

The Nakashima U.S. Patent No. 5,643,368 in column 1 in lines 45 to 55 discloses treatment of a silicon wafer wherein the wafer is first immersed in a cleaning liquid comprising hydrogen peroxide and sulfuric acid. This is then followed by rinsing the wafer with pure water. In column 2 in lines 15 to 20, it is stated that a silicon wafer is first dipped into a cleaning liquid mixture of hydrogen peroxide and sulfuric acid followed by rinsing with pure water. In column 4 in lines 39 to 52, it is stated that a silicon wafer is first dipped in pure water and then the wafer is immersed in a solution of hydrogen fluoride. In column 5 in lines 30 to 37, it is stated that a wafer is dipped into a cleaning liquid mixture of hydrogen peroxide and sulfuric acid followed by rinsing in pure water. Then in column 6 in lines 37 to 49, it is stated that a silicon wafer is first rinsed with pure water and then the wafer is dipped into an oxidizing agent, such as nitric acid.

Thus it is quite clear that the disclosure of Nakashima is directed to an aqueous treatment agent solution which includes

acid rather than alkaline components. Thus claim 1 has been amended to include the limitations of claim 2 wherein the aqueous treatment agent solution "consists essentially of an oxidizing agent and an alkaline component". Also the process of claim 1 has been amended to recite "consists essentially of the steps of" those set forth in claim 1. Thus claim 2 has been canceled without prejudice and the limitations thereof have been incorporated into claim 1. It is believed that this clearly distinguishes over the teachings of Nakashima.

The Parassis U.S. Patent No. 4,950,359 teaches in column 1 in lines 10 to 12 and in column 1 in lines 55 to 66 that a coating containing niobium may be removed from a substrate by using an aqueous solution of an alkali metal hydroxide and hydrogen peroxide. The substrate is copper. In column 2 in lines 29 to 35, it is stated that the substrate may be copper or a copper-based alloy and that the coating may be niobium or a niobium alloy. In column 3 in lines 5 to 10, it is stated that the cleaning process is especially suitable for cyclotrons in order to remove a super-conducting coating of niobium or niobium alloy from the copper wall of the cavities forming the electrodes supplied with high frequency current.

Claim 1 has been amended to state that the process "consists essentially of" the steps recited therein for polishing semiconductor wafers and immediately after polishing the semiconductor wafer using an aqueous treatment agent solution "consisting essentially of" an oxidizing agent and an alkaline component. Thus it is believed that this excludes the teaching of *Parissis* wherein the substrate is copper which is not a semiconductor wafer and this excludes the coating containing niobium. Also *Parissis* is believed to be nonanalogous prior art.

The *Hayashida* U.S. Patent No. 5,580,846 in column 1 in lines 5 to 8 discloses treating agents for improving the cleaning of the surfaces of semiconductors and LCDs. In column 3 from line 35 through line 65, this reference discloses that semiconductor wafer surfaces are treated with a treating agent and ultrapure water containing a complexing agent having three or more hydroxyamide groups in the molecule.

$$\begin{array}{c} \text{O} \text{ OH} \\ || \\ -\text{C}-\text{N}- \end{array}$$

It is believed that the amendments to claim 1 to recite "consisting essentially of" exclude the complexing agent having three or more hydroxyamide groups as disclosed in *Hayashida*.

Also, Hayashida in column 5 lines 25 to 30 and in column 6 lines 1 to 15 discloses that the complexing agent of Hayashida is to remove absorbed amounts of aluminum ions from the silicon wafer surface. These aluminum ions are also excluded by the recitation of "consisting essentially of".

Also, none of these prior art references teach or suggest polishing a surface of a semiconductor wafer and immediately after this polishing contacting this surface with the aqueous treatment agent solution. The Table on page 8 of the present specification shows the new and unexpected results according to the process of the invention when compared to the prior art.

For all these reasons, none of the prior art references provide an identical disclosure of the claimed invention. Hence, the present invention is not anticipated under 35 U.S.C. 102. Withdrawal of this ground of rejection is respectfully requested.

In summary, claim 2 has been canceled without prejudice. Claim 1 has been amended. In view of these amendments, it is believed that all the claims, and the invention, are patentable over all the prior art references applied by the Patent Examiner under 35 U.S.C. 103. A prompt notification of allowability is respectfully requested.

Respectfully submitted,

HEINRICH HENNHÖFER

Edward Freedman

Allison C. Collard
Edward R. Freedman
Registration No. 26,048
Attorneys for Applicant

COLLARD & ROE, P.C.
1077 Northern Boulevard
Roslyn, New York 11576
(516) 365-9802

I hereby certify that this correspondence is being deposited with
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20231, on September 23, 1999.

Ellen Horan

Ellen Horan